students with an elementary treatment of rigid dynamics, and was reviewed in NATURE of May 5, 1892 (vol. xlvi. p. 4), has so successfully fulfilled its purpose that it is now in its fourth edition. In this edition the author directs special attention to the use of the "inertia skeleton," in which a body is replaced by a dynamically equivalent system of three thin wires placed along the three principal axes at its centre of mass. This method of representation has been found to appeal to non-mathematical students far better than the conventional momental ellipsoid. Further attention has also been given to experiments with a gyroscope, which are so easily made that it is a matter for congratulation that they can now be studied in an elementary treatise. The author introduces the name "slug" to denote the mass to which a foot-pound unit of acceleration is produced by a gravitation unit of force.

ACCORDING to recent investigations, liquid sulphur dioxide is a solvent in which a large number of substances, organic and inorganic, are readily soluble. From experiments of Walden and Centnerszwer, published in the *Zeitschrift für physikalische Chemie*, it appears that sulphur dioxide forms complex compounds with many of these substances. From solutions of potassium iodide in liquid sulphur dioxide, they have obtained a crystalline compound of the formula $KI.4SO_2$, which melts at +0°·26 C. Similar compounds are in all probability formed by other salts, and the name of "sulphones" is ascribed to this class of bodies.

IN the current number of the *Zeitschrift für physikalische Chemie* is a noteworthy paper by Messrs. Alexander Smith and W. B. Holmes in which the nature of amorphous sulphur is discussed. This so-called amorphous sulphur is formed when liquid sulphur is maintained in the molten condition for some time, and its amount increases as the temperature is raised. A method of determining the proportion of amorphous sulphur in the liquid variety has been worked out which depends essentially on the great difference in solubility of the two forms in carbon bisulphide. From parallel determinations of the proportion of amorphous sulphur and of the freezing point of the melt, it is shown that the lowering of the freezing point below 119°·25 C. is proportional to the quantity of the dissolved amorphous sulphur. The molecule of the latter in the solution of the soluble liquid form is found to be represented by the formula S_8.

A NEW reducing agent which promises to be of considerable service is described by Mr. E. Knecht in the current number of the *Berichte*. From the analogy between titanium and tin, it appeared likely that the chloride of titanium on reduction would give a lower chloride $TiCl_2$, analogous to stannous chloride. The reduction of the acid solution of the tetrachloride of titanium, however, produced the trichloride already known instead of the expected dichloride, but this, on examination, proved to possess remarkable reducing properties. Whilst applicable to reduction in a similar manner to stannous chloride, titanium trichloride is more powerful. Copper salts can be reduced to metallic copper; sulphites may be quantitatively reduced to hyposulphites, or, if the action be pushed, sulphur is produced. By careful neutralisation with soda, the titanium can be completely removed as the hydrated oxide. The behaviour of titanium trichloride towards organic substances is also of interest; nitro-bodies are reduced immediately to amines, and in the case of substances containing more than one nitro group, the partial reduction is readily effected. Azo-bodies are attacked so sharply that they may be quantitatively estimated, and other reactions are given showing the wide range of applicability of this reagent.

SOME time ago it was shown by M. C. E. Guillaume that it was possible to obtain nickel steel alloys which possessed extremely low coefficients of expansion, and in the current number of the *Comptes rendus* he gives a more detailed study of the conditions necessary to obtain such alloys. The expansion is influenced considerably by the presence of foreign elements such as manganese, carbon and silicon, and it has been found that if these are reduced below a certain amount, the alloy cannot be worked. Working under the most favourable conditions, an alloy has been obtained possessing a coefficient of expansion $\alpha = (+0{\cdot}028 - 0{\cdot}00232\theta)10^{-6}$, a figure which can be better understood when it is stated that a wire made of this steel, one kilometre in length, would alter in length in passing from 0° to 20° C. less than 0·4 mm. The importance of an alloy possessing such properties in geodetic work is obvious, and extensive use has already been made of it in the geographical service of the French army, in the marine hydrographical service and elsewhere. All temperature corrections in geodetic work become superfluous.

THE additions to the Zoological Society's Gardens during the past week include a Barnard's Parrakeet (*Platycercus barnardi*) from Australia, presented by Mrs. Jebb; a Hawfinch (*Coccothraustes vulgaris*), British, presented by Miss H. Brown; a Rufous Rat-Kangaroo (*Æpyprymnus rufescens*) from New South Wales; two Corean Cattle (*Bos taurus*, var.) from Corea, six Proteus (*Proteus anguinus*) from the Caves of Carniola, deposited.

OUR ASTRONOMICAL COLUMN.

ELEMENTS AND EPHEMERIS OF COMET 1903 *a*.—The following elements and ephemeris for this comet have been calculated, by M. G. Fayet, of Paris Observatory, from observations made at Nice (January 19), Besançon (January 24) and Paris (M. Bigourdan, January 27); the necessary corrections for aberration and parallax have been made.

T = 1903 March 28·9468 M.T. Paris.

$$\left.\begin{array}{rcrrr} \omega & = & 130^\circ & 40' & 55'' \\ \Omega & = & 0 & 41 & 56 \\ i & = & 35 & 35 & 6 \end{array}\right\} 1903{\cdot}0$$

$$\log q = 9{\cdot}67479$$

Ephemeris 12h. M.T. Paris.

Date.		α app. h. m. s.	δ app. ° ′	log r	log Δ	Brightness.
Feb. 9	...	23 24 50	+ 8 7·1	0·0619	0·2517	2·1
13	...	23 31 17	+ 9 27·7	0·0348	0·2395	2·5
17	...	23 38 16	+10 53·7	0·0056	0·2257	3·1
21	...	23 45 49	+12 25·1	9·9742	0·2101	3·8
25	...	23 54 3	+14 2·5	9·9403	0·1923	4·8
March 1	...	0 3 2	+15 45·5	9·9039	0·1721	6·3

The brightness on January 19 (about 10m. 0–11m.·0) is taken as unity (*Astronomische Nachrichten*, No. 3845).

THE CONSTANT OF ABERRATION AND THE SOLAR PARALLAX.—In No. 529 of the *Astronomical Journal*, Dr. Chandler gives the results of an exhaustive inquiry, which he has conducted during the last ten years, into the various values obtained for the constant of aberration by different observers and methods. After discussing the trustworthiness of the methods employed, Dr. Chandler apportions various weights to the results obtained, and then rejects a number of these results as being too uncertain. He then determines the constant from the accepted results, and obtains, as the general mean, the value 20″·521 with a probable error of ± 0″·005.

In order to show the effect of incorporating *all* the results, he determines the weighted mean of all the values and thereby obtains the value 20″·517.

As a final result of the inquiry, Dr. Chandler accepts the value of 20″·52 for the constant of aberration, and this produces the value 8″·78 for the solar parallax.

A NEW FORM OF SPECTROSCOPE.—In No. 12, vol. xxxi.,

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of the *Memorie della Societa degli Spettroscopisti Italiani*, Signor Antonio Sauve describes a new form of spectroscope which he has devised and calls the "Filtro Spettroscopico."

This instrument enables an observer to view directly, or to photograph, the monochromatic image of any object which emits light of the desired wave-length.

Among the various observations for which the author suggests the instrument may be used, he includes the observing of prominences and other solar phenomena, and claims the following advantages for his method over the methods now practised:—(1) The prominences on the *whole* of the solar disc may be observed visually, and (2) the surface may be observed, visually or photographically, as a whole, instead of having to be taken in sections as is done at present.

REPORT OF THE UNITED STATES NAVAL OBSERVATORY.—This comprehensive report deals with the work done during the fiscal year ending June 30, 1902, and is full of interesting descriptions of the methods employed and the results obtained.

A large diurnal temperature change in the azimuth constant of the 6-inch transit circle has been eliminated by substituting brick and Portland cement piers for the marble piers on which the instrument formerly rested.

With the 26-inch equatorial, important work has been done in determining the diameters of the planets and their satellites, and, by comparing the diameters obtained at night-time with those obtained at twilight, the constants of the variations due to irradiation have been determined. The results are given in a complete and interesting table. The value for irradiation in the case of Mars varies from 0″·70 when the planet is in aphelion to 1″·02 when it is in perihelion, and should, therefore, always be taken into account in observations made at different epochs.

During the year, photographs of the sun were obtained with the 40-feet photoheliograph on 200 days, and these showed the presence of spots on 45 days. Although the average number of spots for the whole year is less than during the previous year, the average frequency from October to July is slightly greater, thus indicating that the sun-spot minimum has probably been passed.

Reports on the 12-inch equatorial, the prime vertical transit instrument and 5-inch altazimuth, the magnetic and meteorological sections, and several other instruments and departments are also given in detail.

A NEW 18-inch refractor is being made by Messrs. Alvan Clark and Sons for Amherst College Observatory.

WE are pleased to learn that the recent fire at Yerkes did no injury to the 40-inch refractor, but some damage was done in the coelostat room.

FORESTRY IN THE UNITED STATES OF AMERICA.

TWENTY years ago, the people of the United States did not trouble themselves much about their forests. It was said that enormous areas were stocked with an inexhaustible amount of timber and fuel. Since then a great change has taken place. It has gradually been ascertained that, although the total forest area is estimated at about 700 million acres, the average stand does not amount to more than about five tons per acre, which is equivalent to about one-tenth of what it would be in systematically managed forests; in other word, the stand of timber in the United States forests is equal to the stand in about 70 million acres of forests such as are to be found in Germany and a great portion of France. Since it has been ascertained that the actual cuttings of timber in the United States exceed already 100 million tons a year, it follows that the present stand must be used up in about thirty years. Nor is the quantity removed annually from the forests replaced by new growth, as the latter has been estimated to amount to about 75 million tons. Moreover, it must not be forgotten that the annual forest fires destroy enormous quantities of material.

As already stated, these matters began to attract attention some twenty years ago. Thoughtful people wrote about them, societies were formed, information collected and made available to the general public. The State Governments issued regulations so as to prevent further destruction by fire, and they established certain State parks. Nor did the Federal Government neglect the matter. A Chief of the Forestry Division of the Agricultural Department was appointed, Mr. Fernow, who got together statistics and spread sound ideas regarding the rational treatment of forests. He was succeeded, a few years ago, by Mr. Gifford Pinchot. The latter went, about fourteen years ago, to study forestry in Germany and France. After his return to America, he set up in New York as a "consulting forester" (though a very wealthy young gentleman). Mr. George Vanderbilt engaged him to manage his forests at Biltmore, now amounting to more than 100,000 acres, having for his object to see whether systematic forestry can be made to pay in the States. In this post Mr. Pinchot was succeeded, about eight years ago, by Dr. Schenck, a first-class German forester.

When Mr. Fernow left his post at Washington, he became Professor and Dean of the Faculty of Forestry at Cornell University, endowed by the State of New York with money, and 30,000 acres of forest lands in the Adirondacks for systematic management and practical instruction. Soon after Mr. Gifford Pinchot took up the post at Washington, he and his family presented Yale University with the sum of 30,000*l*. for the purpose of endowing a second forest school in connection with the University; they also established a summer school for the study of forestry by those who could not afford to proceed to a regular degree at the University. According to the report for 1901–2, there were thirty-one students of forestry at Yale University and twenty-seven attending the summer school.

At Biltmore, Dr. Schenck has established a third forest school, where, on October 1, 1902, sixteen students were in attendance. I had on two occasions the pleasure of conducting students of this school through some of the most interesting forests of south Germany (seven in 1900 and six in 1902), these young gentlemen having, at the conclusion of their course at Biltmore, come to see something of systematic forest management in Europe.

Apart from the above three higher schools, forestry is now taught at about forty other educational establishments in the United States. In this way, quite a respectable number of well-trained forest experts has become available, in addition to about half-a-dozen young men who followed Mr. Pinchot's plan and studied in Germany.

The Federal Government has, by degrees, inaugurated a systematic forest policy, progress having been specially rapid since Mr. Pinchot became head of the Forestry Bureau. An area of 46 million acres of Government land has been declared (chiefly in Mr. Cleveland's time) "reservations," by Presidential proclamation. These areas are situated in the west. And now President Roosevelt has sent a message to the Senate and House of Representatives recommending a national forest reserve of considerable extent in the Southern Appalachian region, this measure being, as he states, "an economic need of prime importance to the welfare of the south, and hence to that of the nation as a whole."

Another matter vigorously taken up by the Bureau of Forestry is the preparation of rational working plans for private forests. A considerable number of field assistants have been engaged, who are sent out to prepare working plans for the forests of such private proprietors as apply for them. So great has been the demand in this respect that, although last year plans were prepared for more than one million acres, the field assistants could deal with only about one-tenth of the applications received at the head office.

All the while, the collection of statistics and dissemination of useful information proceeds at a most rapid rate. In this respect I may mention that I have during the last three months received the following reports and pamphlets:—

(1) "The Timber Resources of Nebraska," by W. Hall, Superintendent of Tree Planting, Bureau of Forestry.

(2) "Grazing in the Forest Reserves," by Filibert Roth, of the United States Department of the Interior, in charge of the work in the Government forest reserves.

(3) "A Working Plan for Southern Hardwoods and its Results," by J. Foley, Field Assistant, Bureau of Forestry.

(4) "A History of the Lumber Industry in the State of New York," by Colonel W. Fox, Superintendent of Forests, New York State.

(5) "The Western Hemlock," by G. E. Allen, Field Assistant, Bureau of Forestry.

(6) The above-mentioned message by President Roosevelt, transmitting a magnificent volume of reports on the forests, rivers and mountains of the Southern Appalachian region.

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